Exploration Capabilities

Lunar CATALYST

Completed Technology Project (2014 - 2019)

Project Introduction

Lunar Cargo Transportation and Landing by Soft Touchdown (Lunar CATALYST) is a NASA initiative to encourage the development of U.S. private-sector robotic lunar landers capable of successfully delivering payloads to the lunar surface using U.S. commercial launch capabilities. In September 2014, NASA entered into no-funds-exchanged Space Act Agreement (SAA) partnerships with three competitively-selected companies (Astrobotic Technology, Masten Space Systems, and Moon Express), and is providing in-kind contributions including technical expertise, access to test facilities, software, and the loaning of equipment.

Although NASA is providing in-kind contributions, the landers are owned by the industry partners, and much of the technical design and development information is proprietary. General information about Lunar CATALYST is available on NASA's website (http://www.nasa.gov/lunarcatalyst), and additional information may be obtained from the companies themselves: Astrobotic Technology, Masten Space Systems, and Moon Express.

In May 2019, all three of the Lunar CATALYST companies were selected for the Commercial Lunar Payload Services (CLPS) program to deliver science and technology payloads.

Anticipated Benefits

Development of commercial capabilities to deliver payloads to the lunar surface may provide a cost-effective means of executing various types of science and exploration missions on the Moon. Missions like NASA's Resource Prospector, which aims to find, excavate, and characterize lunar volatiles such as water, hydrogen, and oxygen, could benefit from these capabilities.

Development of commercial capabilities to deliver payloads to the lunar surface may provide a cost-effective means of executing various types of science and exploration missions on the Moon, including:

Astrobotic Technology, Masten Space Systems, and Moon Express RoboticLunar Landers

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- **Resource prospecting.** Surface missons to characterize the extent, distribution, and form of lunar volatiles such as water, hydrogen, and oxygen will provide critical "ground truth" and inform the development of sustainable and affordable exploration architectures. A Lunar Exploration and Analysis Group (LEAG) report concluded that "small near term missions can provide critical data to resolve important unknowns regarding polar volatiles science and resource utilization."
- **Technology demonstrations.** Missions to deploy technology demonstration payloads and use the Moon as a proving ground can lower the risk and accelerate the development of exploration systems, including those with application to the surface of Mars, such as regolith processing, habitation, and mobility.
- **Sample return.** In the report, Vision and Voyages for Planetary Science in the Decade 2013-2022, the National Research Council recommended Lunar South Pole-Aitken Basin Sample Return as a candidate NASA New Frontiers science mission.
- **Geophysical network deployment missions.** In the report, Vision and Voyages for Planetary Science in the Decade 2013-2022, the National Research Council recommended Lunar Geophysical Network as a candidate NASA New Frontiers science mission.

The Lunar CATALYST initiative encourages and facilitates development of U.S. commercial robotic lunar cargo delivery capabilities by bringing decades of technical experience (most recently NASA's Mighty Eagle and Morpheus projects) to bear, and provides NASA technical expertise, access to test facilities, software, and the loaning of equipment. Providing these resources has been a critical force-multiplier that is accelerating the progress of commercial robotic lunar lander development.

Organizational Responsibility

Responsible Mission Directorate:

Exploration Systems Development Mission Directorate (ESDMD)

Lead Center / Facility:

NASA Headquarters (HQ)

Responsible Program:

Exploration Capabilities

Project Management

Program Director:

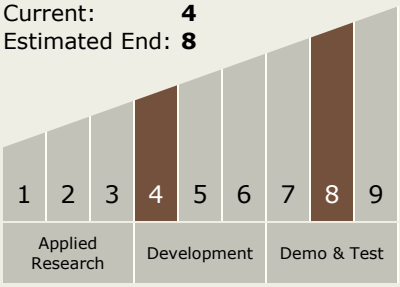
Christopher L Moore

Project Manager:

Greg Chavers

Technology Maturity (TRL)

Start: **4**
Current: **4**
Estimated End: **8**



Technology Areas

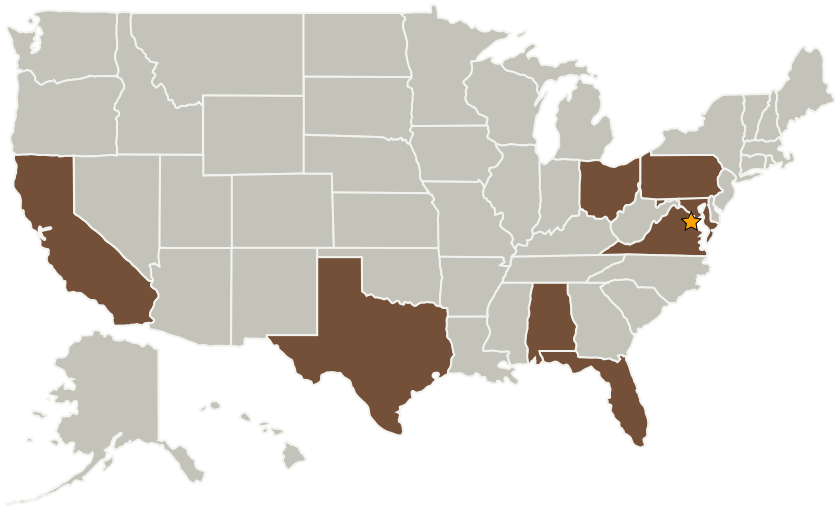
Primary:

Continued on following page.

Lunar CATALYST

Completed Technology Project (2014 - 2019)

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★NASA Headquarters(HQ)	Lead Organization	NASA Center	Washington, District of Columbia

Co-Funding Partners	Type	Location
Astrobotic Technology, Inc.	Industry	Pittsburgh, Pennsylvania
Masten Space Systems, Inc	Industry	Mojave, California
Moon Express, Inc.	Industry	Cape Canaveral, Florida

Primary U.S. Work Locations	
Alabama	California
Florida	Maryland

Continued on following page.

Technology Areas *(cont.)*

- TX07 Exploration Destination Systems
  - TX07.1 In-Situ Resource Utilization
    - TX07.1.1 Destination Reconnaissance and Resource Assessment

Target Destination

The Moon

Supported Mission Type

Planned Mission (Pull)

Primary U.S. Work Locations *(cont.)*	
Ohio	Pennsylvania
Texas	Virginia

Project Transitions

September 2014: Project Start

September 2019: Closed out

Closeout Summary: Close out report provided by Debra Terrell, she submitted company specific data to each of the three companies and received their approval to publish it publically. Company POCs are: Sharad Bhaskaran(Peregrine Mission Ma nager, Astrobotic Technology, Inc.), Sean Mahoney, CEO, (Masten Space Systems), Bob Richards, CEO (Moon Express)

Images

Lunar CATALYST Partners
Astrobotic Technology, Masten Space Systems, and Moon Express RoboticLunar Landers
(https://techport.nasa.gov/image/40919)

Project Website:

http://www.nasa.gov/lunarcatalyst